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ARBL Building, Fort Collins, CO 80523 (US). HERICKHOFF, Lisa [US/US]; Xy, Inc., 3801 Rampart Road, ARBL Building, Fort Collins, CO 80523 (US).

(21) International Application Number: **PCT/US00/42350**(74) Agent: **SANTANGELO, Luke**; Santangelo Law Offices, P.C., Third floor, 125 South Howes, Fort Collins, CO 80521 (US).

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(71) Applicant (for all designated States except US): XY, INC. [US/US]; 1108 North Lemay Avenue, Fort Collins, CO 80524 (US).

(72) Inventors; and

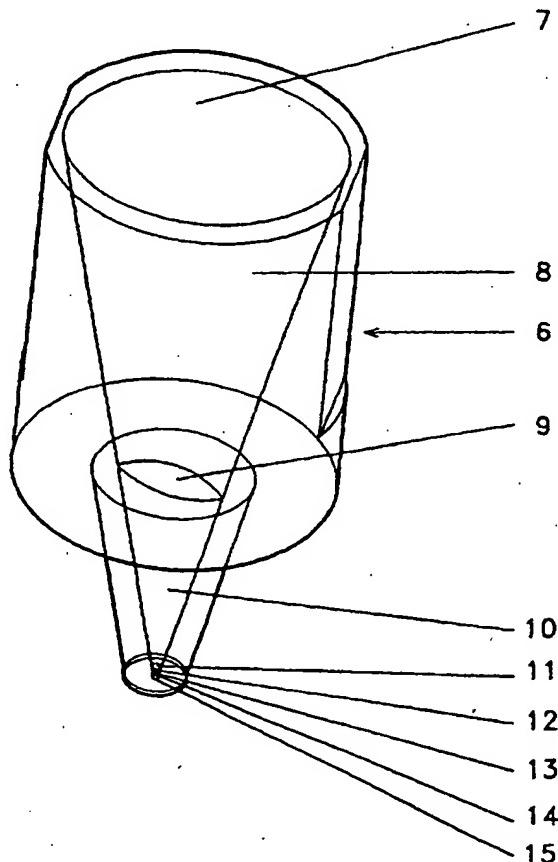
(75) Inventors/Applicants (for US only): BUCHANAN, Kristopher, S. [US/US]; Xy, Inc., 3801 Rampart Road,

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(54) Title: IMPROVED FLOW CYTOMETER NOZZLE AND FLOW CYTOMETER SAMPLE HANDLING METHODS



(57) **Abstract:** An improved nozzle system for a flow cytometer and accompanying methods have been invented for a high efficiency orientation and sorting process of a flat sample and dedicates items such as equine or bovine sperm cells. This improved nozzle system comprises a nozzle (16) with a novel interior surface geometry that can both gently accelerate the cells and can include an elliptical-like, single torsional interior surface element within (c) the nozzle, i.e., a single torsional orientation nozzle (6). The elliptical-like, single torsional interior surface element (e.g.) (8, 9, 10) may have a laminar flow surface and may produce the simplest flow path for applying minimal forces which act in either an accelerative nature or orienting hydrodynamic forces, namely, the single torsional orientation forces, to orient a flat sample (16) such as animal sperm cells into a proper direction for an analyzing and efficiently sorting process in clinical use, for research and for the animal insemination industry.

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A. CLASSIFICATION OF SUBJECT MATTER
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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, INSPEC, COMPENDEX, SCISEARCH, PAJ, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 893 766 A (HOGG WALTER R) 8 July 1975 (1975-07-08) column 2, line 27-34 column 3, line 4-60 column 4, line 18-38 ---	1-3, 70-72 48-51 4-13, 18-47, 52, 55-65, 73-86, 89-141, 144-159, 162-178
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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl.
Fax: (+31-70) 340-3016

Authorized officer

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 05504 A (US AGRICULTURE) 4 February 1999 (1999-02-04) cited in the application	14-17, 53,54, 66-69, 87,88, 142,143, 160,161, 173,180
Y	page 3, paragraph 3 page 5, paragraph 2 -page 8, paragraph 2	48-51
A	US 5 088 816 A (TOMIOKA ATUO ET AL) 18 February 1992 (1992-02-18) column 1, line 52-64; figures 7,11-13 column 8, line 23-27 column 8, line 64 -column 9, line 39	1
A	EP 0 288 029 A (HITACHI LTD) 26 October 1988 (1988-10-26) column 7, line 46 -column 8, line 32	1
A	JOHNSON L A ET AL: "SEX PRESELECTION: HIGH-SPEED FLOW CYTOMETRIC SORTING OF X AND Y SPERM FOR MAXIMUM EFFICIENCY" THERIOGENOLOGY, LOS ALTOS, CA, US, vol. 52, no. 8, 1999, pages 1323-1341, XP001025636 ISSN: 0093-691X page 1329	1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 3893766	A	08-07-1975	US	RE29141 E		22-02-1977
WO 9905504	A	04-02-1999	US	5985216 A		16-11-1999
			AU	8662998 A		16-02-1999
			BR	9810803 A		12-09-2000
			CN	1265195 T		30-08-2000
			EP	0998672 A2		10-05-2000
			WO	9905504 A2		04-02-1999
US 5088816	A	18-02-1992	JP	2808321 B2		08-10-1998
			JP	3105235 A		02-05-1991
			US	RE35227 E		07-05-1996
EP 0288029	A	26-10-1988	JP	1868870 C		06-09-1994
			JP	5075352 B		20-10-1993
			JP	63262565 A		28-10-1988
			DE	3886980 D1		24-02-1994
			DE	3886980 T2		01-06-1994
			EP	0288029 A2		26-10-1988
			US	5007732 A		16-04-1991

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